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ABSTRACT

A 2 x 3 factorial design was employed to assess the efficacy of peer teaching and token reward contingencies (contingent tokens, noncontingent "yoked" tokens, and no tokens) in a remedial reading program. The relationship between on-task performance and reading improvement was also assessed. Forty-two fourth grade to sixth grade rural Appalachian students with at least a one year reading deficit served as subjects. Thirty half-hour remedial reading sessions focused upon oral reading rate and error reduction. Reading rate, error reduction, and comprehension (for which no contingencies were applied) improved more for the group receiving both contingent reward and peer teaching than any other group. On-task performance remained above the 90% level for all groups receiving either contingent reward or peer teaching. It was suggested that increasing on-task performance may be necessary, but not sufficient to improve academic performance. (Author)

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THE EFFICACY OF REWARD CONTINGENCIES AND PEER TEACHING ON READING SKILL ACQUISITION AND ON-TASK ATTENDING WITH ELEMENTARY SCHOOL CHILDREN[1,2]

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Behavior modification programs have been successfully employed to improve classroom attending behavior (Walker and Buckley, 1968; Surrat, Ulrich, and Hawkins, 1969) and to increase academic response rates (Corey and Shamow, 1972; Lovitt and Curtiss, 1968, 1969) and accuracy (Lakey, McNees, and Brown, 1973). Recently, Kirby and Shields (1972) applied contingent praise and correctness feedback to the acquisition of improved arithmetic response rates. Although their study indicated that time spent attending increased collaterally with the increase in academic response rate, Kirby and Shields did not determine whether improved on-task attending was sufficient to produce an increase in arithmetic skill.

Staats and his colleagues (1964, 1965, 1967, 1969) were the first to apply reward contingencies to the acquisition of reading skill. Paraprofessionals, such as teachers, parents, and high school students, conducted sessions consisting of training in oral reading, new word acquisition, silent reading and comprehension training. Oral reading, for example, was reinforced with a token whenever the student completed a paragraph without error. Smaller value reward was presented if a paragraph had to be repeated to obtain errorless performance.

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The Scientific Research Associates (SRA) reading material was adapted for remedial training.

Fox (1972) modified the Staats program and used the state adopted reading series as a training vehicle. An undergraduate teacher's assistant conducted the training sessions which focused solely on oral reading rate and error reduction through the addition of a time contingency. Unlike the research of Staats and Butterfield (1965) and Camp and Van Doornick (1971), it was found that comprehension improved concommitantly with reading rate and error reduction. As in the Staats research program, no measure of on-task behavior was obtained.

The present study utilized a factorial design to assess the efficacy of the token reward contingencies employed by Fox and peer teaching rather than the paraprofessional teaching employed by both Staats and Fox. The study was also designed to evaluate the relationship between on-task performance and reading improvement.

Methods

Subjects. Forty-two fourth- through sixth-grade students with at least a one year diagnosed (see below) reading deficit were chosen as subjects if the reading specialist[3] suggested they had basic phonic ability and were less than optimally motivated. In addition, 18 fifth and sixth grade students without a diagnosed reading deficit served as peer teachers (PT). All Ss were students at a rural Appalachian elementary school to which the senior author was contracted to supervise the institution of a token economy for remediation of academic and behavioral deficiencies.

Reinforcer System. A token economy had just been established throughout the school. Reward for the present study consisted of colored check marks placed on a data sheet next to S contingent upon correct reading responses. A blue check was worth 6 points. A red check was valued at 4 points. A yellow check was

worth 2 points. The points could be exchanged for tokens used in the school-wide token economy at the rate of 10 points per token. Tokens could then be exchanged for various priveleges (such as attending school ball games, using the coke machine, etc.) which are described in more detail elsewhere (Fox, 1972).

Reading Material. The MacMillan Graded Reading Series (1965) was used throughout remedial training. Pencil lines were drawn to delineate approximately 50 word reading segments.

Pre- and Post-Tests. The Spache Diagnostic Reading Scale and the Slosson Oral Reading Test were administered (blind) to all Ss prior to and following remedial training. In addition, pre- and post-test oral reading rates and errors per 100 words were assessed from three four-minute taped reading samples from the Sheldon Graded Reading Series (1968). The three tests for each S were taken from the reader at his Spache-diagnosed reading level and one year above and below that level. Although pre- and post-test selections at a given level were the same for all Ss, pre-test selections were not the same as post-test selections. As S read, he was told the correct word if 1) he asked, 2) he erred, or 3) 5 secs. elapsed without a response. The tapes were scored blindly by an independent observer naive to the purpose of the research.

Procedure. Conceptually, six experimental groups of 7 Ss each formed a 2 x 3 (Peer Teacher X Reward Condition) factorial design. The groups were equated on the basis of pre-test Spache scores and received the following treatments:

Gp CP: This contingently rewarded/peer taught group received tokens dispensed by a peer teacher contingent upon oral reading performance.

Gp NCP: This non-contingently rewarded/peer taught group received tokens at the end of each session to match the amount earned by the CP student attending that reading session. Ss were unaware of this "yoked-control" procedure.

Gp NRP: This non-rewarded/peer taught group read to a peer teacher without token reward.

Gp CNP: This contingently rewarded/non-peer taught group was instructed to reward themselves contingent upon oral reading performance.

Gp NCNP: This non-contingent/non-peer taught group naively received tokens at the end of each session to match the amount earned by the CP S attending that session.

Gp NRNP: This non-rewarded/non-peer taught group read orally by themselves without token reward.

Daily reading sessions lasted approximately one-half hour and were scheduled 45 min. apart over 30 consecutive school days. Each session was comprised of six Ss (one from each group) and three peer teachers. The desks in the reading room were well separated except for those of peer teachers who sat to the immediate right of their charges. The reading material (books open to the appropriate page, colored pens, and data recording sheets) was placed on the desks of Ss prior to the start of the session. Daily reading sessions consisted of three phases and were administered as follows for Gp CP:

Phase I began by allowing each S to read orally for exactly 10 min. from the MacMillan Graded Reading Series (1965) book one year below the level estimated by the Spache pre-test. The passages were divided into 50 word reading segments. When correct reading responses were made to each word in a segment, PT placed a blue check mark (large reward) on the data sheet in full view of S along with a word of praise. S then continued to the following segment. When a reading segment contained an error, S was corrected and instructed to spell and repeat the word correctly while looking at it. S then completed the segment without reward. The paragraph was immediately repeated. If no incorrect response occurred during the second reading of the passage, a medium value reward (red check mark) was

presented and S continued to the following reading segment. If an incorrect response occurred, no reward was given and the segment was again repeated. Perfect performance on the third or subsequent reading of a segment was rewarded with a small value (yellow check mark) token. At the start of each session the reading specialist carefully explained to S that it was to his advantage to read as quickly as possible without error during the fixed 10-minute Phase I time interval. The number of tokens obtained, words missed, segments repeated and segments completed were tabulated by S and PT before continuing to Phase II. Phase II of each session immediately followed Phase I. PT printed each incorrect Phase I reading response on a separate 3 x 5 index card. Stimulus words were presented individually and S was asked to pronounce them. A correct response to a word-stimulus card was reinforced with a red check mark. Following the correct response to a word, that card was dropped from the group of cards yet to be presented. When an incorrect response occurred, however, PT pronounced the word and asked S to spell and recite the word while looking at the card. The word was neither dropped from the group of cards nor reinforced until it was later read correctly without prompting. If an error occurred to a word-stimulus, a yellow check mark was awarded when responded to correctly on subsequent presentation. Phase III was initiated immediately upon completion of Phase II and was an exact duplication of Phase I. S began by reading the same passages under the same reward contingencies. At the completion of Phase III, S assisted PT in plotting a bar graph illustrating the improvement (tokens earned) from Phase I to Phase III.

The format for the daily reading sessions was essentially identical for all Ss. The primary difference in treatment between groups involved the consequences of oral reading performance and the presence or absence of peer teachers. All groups were instructed to read aloud and reread segments containing errors during

Phases I and III. All groups studied Phase I errors printed on 3 x 5 cards during Phase II. Reading performance (number of errors, segments completed and segments repeated) for Phases I and III was graphed daily for all groups. Groups without peer teachers were instructed to handle the peer teacher duties themselves. All Ss advanced one reading level (one book) each week.

On-Task Behavior. The reading specialist recorded "on-task" behavior three days a week during the 10 min. Phase III period. A mark on a data sheet was placed next to the name of each S for each of 40 15 sec. intervals in which he was reading aloud for the entire interval. The percent of on-task intervals was calculated for each group daily. A second observer, naive to the experimental design, provided a reliability check once each week. Average agreement between observers was 98%. Agreement ranged from 94% to 100%.

Peer teachers were paid at the rate of 15 tokens per session. Although provision for peer teacher "reduced pay" for lack of cooperation existed, it was never employed.

Results

The results of the study attest to the superiority of contingently reinforced/peer taught Ss over all others. Figure 1 shows group mean difference (pre- minus post-test) scores on the Slosson and Spache tests. Gp CP improved more than the others on both measures while groups receiving no reward (gps NRP

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Insert Fig. 1 about here
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and NRNP) improved the least. A two factor (Peer Teacher X Reward Conditions) covariance analysis, with pre-test scores serving as the covariate, was performed over the Slosson and Spache scores. A Reward Conditions main effect ($F(2,35)=5.45$, $p<.01$) and a Peer Teacher X Reward Conditions interaction ($F(2,35)=3.64$, $p<.05$) was obtained on the Slosson scores. Spache scores yielded significant

Peer Teacher ($F(1,35)=4.55$, $p<.05$) and Reward Conditions ($F(2,35)=10.82$, $p<.01$) main effects and a trend toward Peer Teacher X Reward Conditions ($F(2,35)=2.64$, $p<.10$) interaction. Inspection of Figure 1 suggests that the interaction on both measures was due to the superiority of Gp CP scores over all others.

Figure 2 illustrates group mean differences (pre- minus post-test) in (2A) words per minute and (2B) errors per 100 words. Reading rate improvement (2A) was greatest for Gp CP and least for Gp NCP. Two factor (Peer Teacher X Reward

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Conditions) covariance analysis with pre-test rate as the covariate yielded main effects of both Peer Teacher ($F(1,35)=9.53$, $p<.01$) and Reward Conditions ($F(2,35)=12.22$, $p<.01$). Error percentage (2B) decrement was greatest for Go CP and least for groups receiving no reward (Gp NRP) or having neither peer teacher nor contingent reward (Gps NCNP and NRNP). These observations are supported by the same analysis of covariance over these data as employed above. Peer Teacher ($F(1,35)=25.82$, $p<.01$) and Reward Conditions ($F(2,35)=15.82$, $p<.01$) main effects as well as a Peer Teacher X Reward Conditions ($F(2,35)=8.57$, $p<.01$) interaction, were obtained.

Figure 3 represents group mean percentages of "on-task" performance (by 15 sec. intervals) over three-day trial blocks. Inspection of the figure

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Insert Fig. 3 about here
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indicates that all groups having a peer teacher and/or receiving contingent reward (gps CP, NCP, NRP, and CNP) remained on-task for more than 90% of the time throughout the study. Groups without peer teaching and contingent reward began at a lower level and on-task performance declined as training progressed. These observations are supported by the findings of a three factor (Peer Teacher X

Reward X Stages of Training) variance analysis in which Stages of Training was a repeated measures factor featuring the first three compared to the last three observations. All main effects (Peer Teacher, $F(1,36)=20.45$, $p<.01$; Reward Conditions, $F(2,36)=4.56$, $p<.05$; and Stages, $F(1,36)=8.71$ $p<.01$) and interactions (Peer Teacher X Reward Conditions, $F(2,36)=7.91$, $p<.01$; Peer Teacher X Stages, $F(1,36)=23.10$, p .01; Reward Conditions X Stages, $F(2,36)=8.30$, $p<.01$; and Peer Teacher X Reward Conditions X Stages, $F(2,36)=12.09$, $p<.01$) were statistically significant.

The data obtained (segments completed, segments repeated, errors, and tokens earned during Phase I and III) throughout the daily reading sessions for Gp CP were essentially identical to those reported elsewhere (F x, 1972). Because inter-group comparisons can not be legitimately made (there is no way to estimate the veracity of the data with non-peer taught groups) data obtained during daily reading sessions will be but briefly summarized for Gp CP. Ss completed more reading segments and received more tokens with fewer segment repeats and errors in Phase III compared to Phase I. Despite progressively more difficult reading material, number of segments read and tokens earned were directly related to the number of training sessions. Despite increased reading rate and more difficult material, percent errors and number of segments repeated were inversely related to the number of training sessions.

Discussion

The results demonstrate the combined effectiveness of contingent reward and peer teaching for the remediation of reading deficiencies. Although the reward contingencies focused solely on oral reading rate and error reduction, concommitant comprehension improvement as measured by the Spache Diagnostic Reading Scale (the comprehension subtest was read silently) was also observed. Motivation to attend to the reading task was mediated by both peer teaching

and contingent reward. CP, NCP, NRP, and CNP Ss remained on-task more than 90% of the time throughout training. As evidenced by the lack of substantial reading improvement for the latter three groups, on-task performance without contingent reward was insufficient to substantially improve reading.

One advantage of directing reward contingencies solely on oral reading performance is that correct responding is more readily defined, measured, and rewarded than is the case for silent reading performance. A second advantage is that comprehension might be efficiently improved without additional time and effort spent on silent reading and comprehension training. This finding is expected to apply especially for those students suffering a motivational deficit. It was assumed that if contingencies of reinforcement could adequately motivate responding, more total responding (practice) would mediate greater reading skill. Furthermore, the reduction of inter-response time (the reciprocal of reading rate) and errors is assumed to increase the probability of cognitive association of earlier to current words in a passage. Comprehension should be directly related to word contiguity; especially for Ss with extremely low initial reading rates. Although it was expected that a time contingency would be traumatic and interfere with performance during the early sessions, no such effect was noted.

With the aide of peer teachers, oral reading performance can be efficiently monitored and rewarded for several students simultaneously. Although the privelege of peer teaching was reported to be sufficiently rewarding, token payment contingent upon following instructions may have mediated the high percentage of on-task time for all Ss having a peer teacher, regardless of whether the students themselves were rewarded. Although having either a peer teacher or contingent reward was sufficient to motivate on-task attending, the combination of contingent reward and peer teaching was necessary to optimize reading improvement.

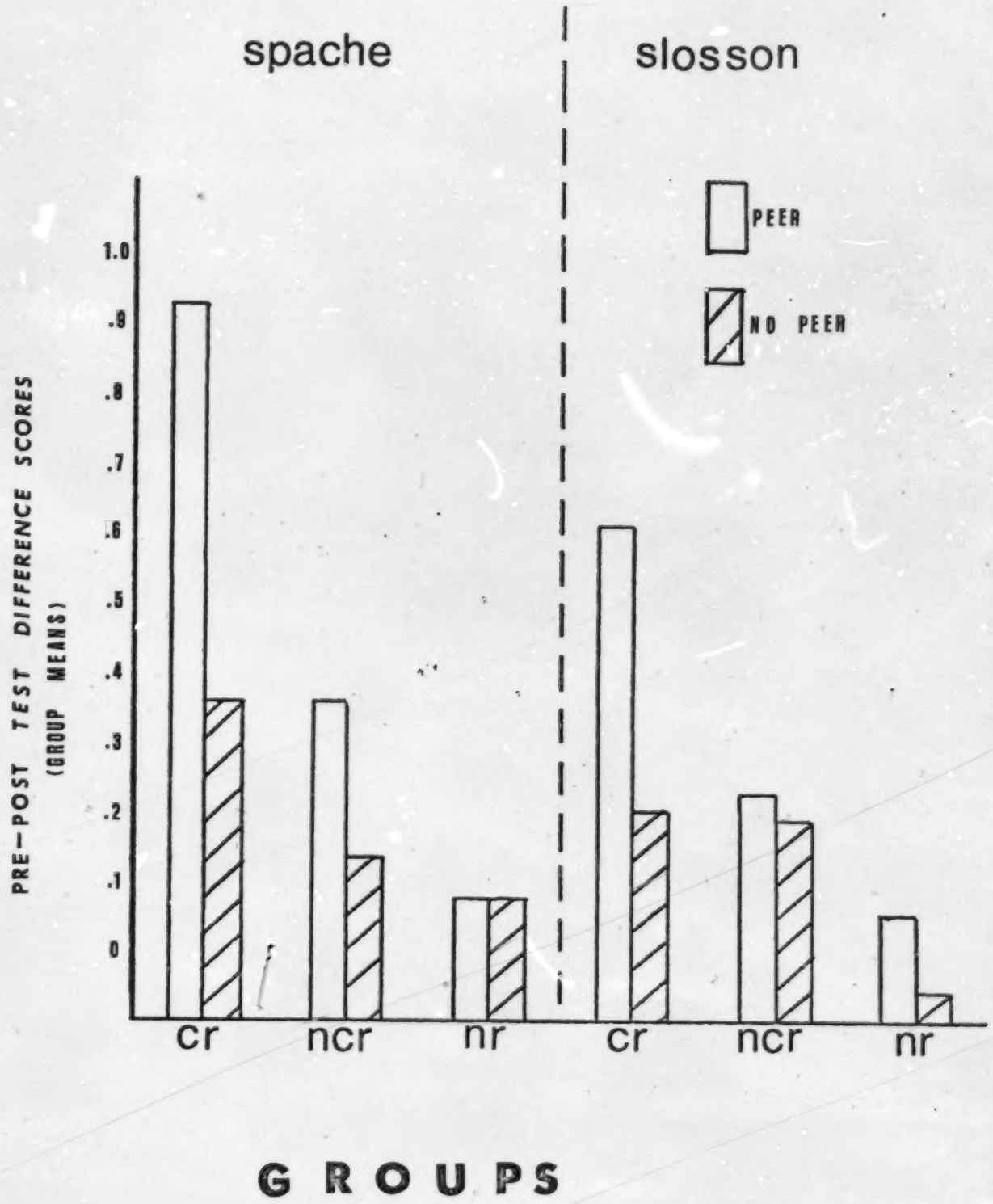
This finding is of particular interest in light of the extensive use of token economies which focus solely upon on-task performance. A child has the apparent ability to behave, look at assigned material, and mouthe words without attaining measureable academic skill improvement.

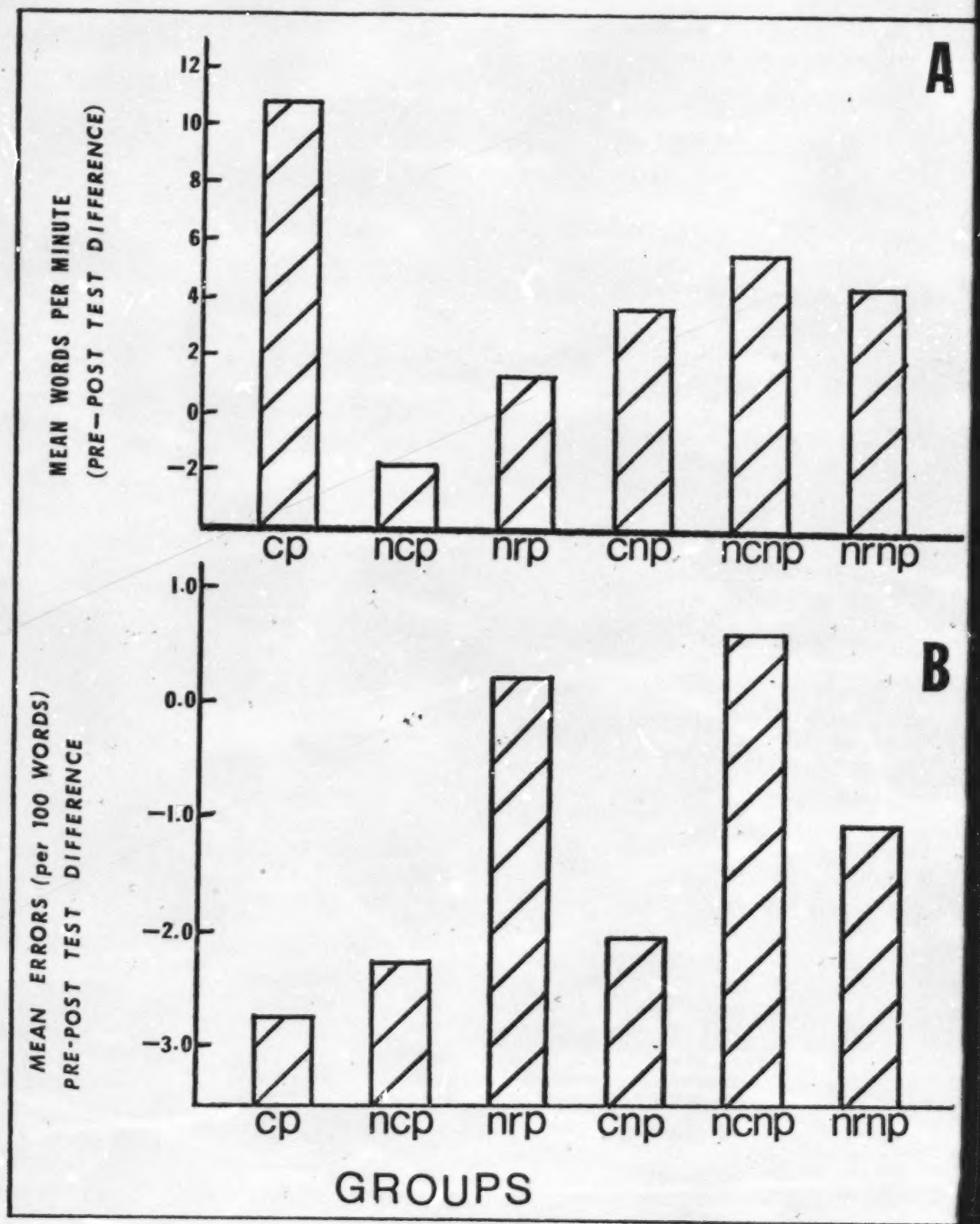
Figure Captions

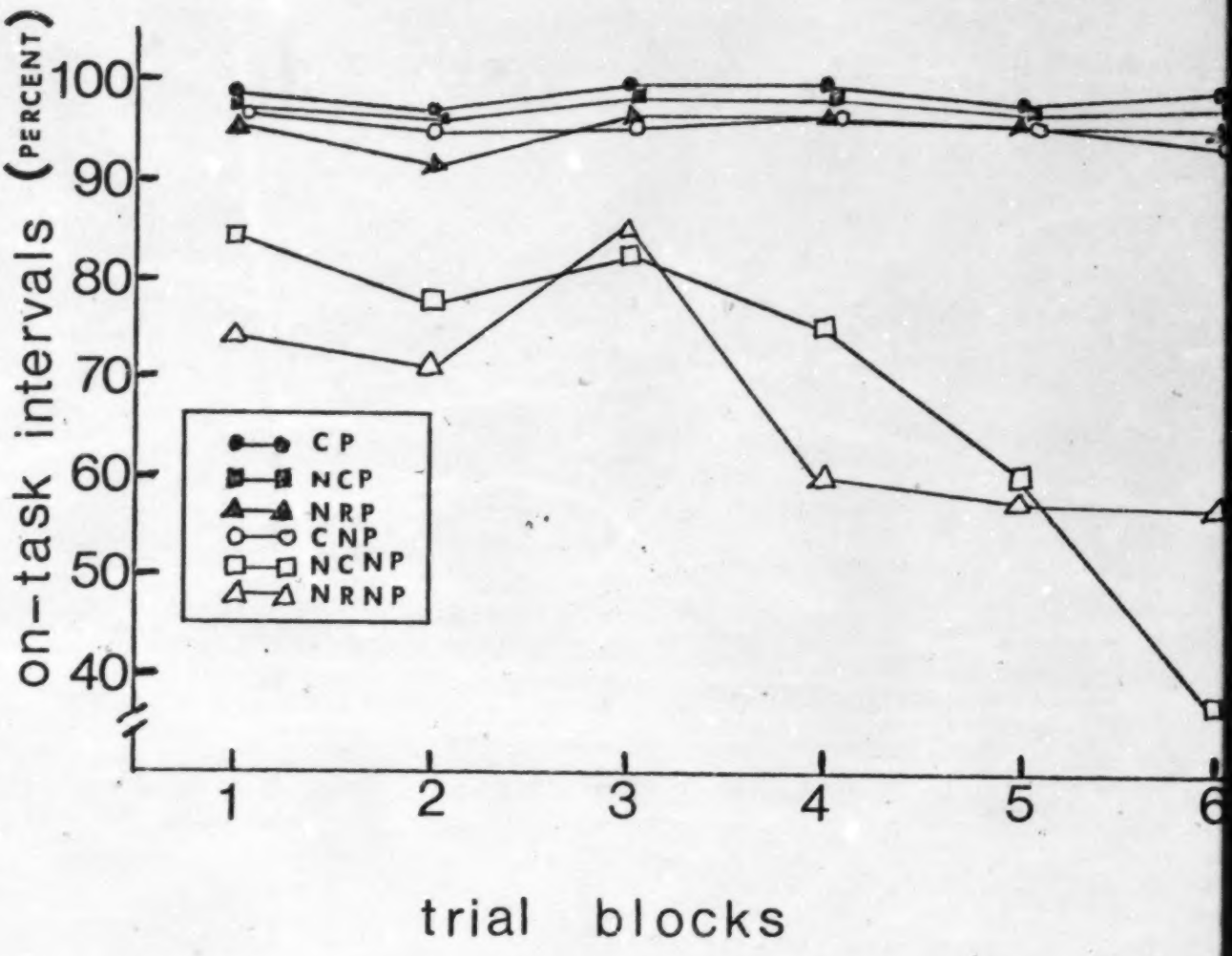
Fig. 1. Group mean difference (pre- minus post-test) scores on the Slosson and Spache tests. The dependent variable is in the form of grade level gain.

Fig. 2. Group mean differences (pre- minus post-test) in (2A) words per minute and (2B) errors per 100 words.

Fig. 3. Group mean percent of on-task performance over 3-day trial blocks. On-task behavior was recorded three times weekly for 10 min. by 15 sec. intervals.


spache
slosson
PEER
NO PEER
PRE-POST TEST DIFFERENCE SCORES
(GROUP MEANS)
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
cr
ncr
nr
cr
ncr
nr
GROUPS


A
MEAN WORDS PER MINUTE
(PRE—POST TEST DIFFERENCE)
12
10
8
6
4
2
0
−2
cp
ncp
nrp
cnp
ncnp
nrnp
B
MEAN ERRORS (per 100 WORDS)
PRE-POST TEST DIFFERENCE
1.0
0.0
−1.0
−2.0
−3.0
cp
ncp
nrp
cnp
ncnp
nrnp
GROUPS


on-task intervals (PERCENT)
100
90
80
70
60
50
40
CP
NCP
NRP
CNP
NCNP
NRNP
1
2
3
4
5
6
trial blocks

Footnotes

[1]This study was supported by Appalachian State University Research Incentive Funds and by Appalachian Region TTT funds. Reprints may be obtained from Paul A. Fox, Dept. of Psychology, Appalachian State University, Boone, NC.

[2]We gratefully acknowledge the cooperation and assistance of Boyd R. Barrier, principal of Boomer-Ferguson Elementary School, Wilkes County, NC and the teachers from whose classes our subjects were withdrawn.

[3]The reading sessions were efficiently run by Judy Hamby, a reading specialist assigned to the school and supported by ESEA Title III funds. Ms. Hamby carried out the research as part of a class project for TTT.

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